Approaching conformality in non-Abelian gauge theories

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Stellingen behorende bij het proefschrift

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1. The exotic phase observed in the SU(3) theory with twelve fundamental (staggered) fermions on the lattice is a result of the competition between local terms and next-to-nearest neighbour interactions introduced by improvement of the fermion action. This is a general feature of improvement which appears as a lattice artefact in the gauge theories of interest in this thesis, but it can also appear as a physical phase in materials such as graphene.

2. The combined evidence indicate that the rapid variation of the chiral condensate observed in the SU(3) theory with twelve fundamental flavours at strong coupling is not to be associated to a finite temperature phase transition as in QCD, but rather indicates a first order zero-temperature phase transition proper of the conformal window.

3. The SU(3) lattice system with twelve fundamental flavours exhibits restored chiral symmetry and retains signatures of the underlying conformal symmetry of the fixed point.

4. The small value of the fermion mass anomalous dimension for the SU(3) theory with twelve fundamental flavours suggests a change of paradigm: this theory is not located close to the lower edge of the conformal window, as it was previously believed, but significantly above it.

5. The results presented in Chapter 3 point at a lower edge of the conformal window for SU(3) gauge theories with fermions in the fundamental representation below eight flavours and close to seven, in agreement with perturbation theory calculations and large-N arguments.

6. The perturbative results presented in Chapter 3 on the anomalous dimension of the scalar glueball operator beg for a nonperturbative confirmation, given their theoretical and phenomenological implications.

7. From the phenomenological point of view, the results presented in this thesis make SU(3) gauge theories with fermions in the fundamental representation more attractive, since conformality can be achieved for a considerably lower number of flavours than what was initially believed.

8. The efforts and computational resources dedicated by researchers in lattice field theory into understanding the phase diagram of gauge theories have provided us not only with a greater understanding of this vast subject, building an important framework for models of Physics beyond the Standard Model, but it has also equipped lattice theorists with the computational tools, algorithmic strategies and the experience to tackle many new problems in field theory.

9. Brazilian politics and economics are as conceptually wrong as the Dutch notion of a proper lunch.

10. B I.II.III RUG REC AS BN CO DW / QCDW DPCX ISDQ HIMD PVRY CPIH JOIX MNJH JSAS QPBI TQNL YTZF OZGV ZORH NFWI WTCG ZMXO PKOM ZVTI YDQY NTSJ XQXE M (see section three of http://enigma.louisedade.co.uk/help.html)